Mathematical model to examine routine fecal microbiota transplantation to prevent and treat *Clostridium difficile*

E.T. Lofgren[1], R.W. Moehring[3], D. J. Weber[2], D.J. Anderson[3] and N.H. Fefferman[4]

[1]NDSSL, Virginia Bioinformatics Institute, [2]Department of Medicine, University of North Carolina at Chapel Hill, [3]Duke Infection Control Outreach Network, Duke University School of Medicine, [4]Department of Ecology, Evolution and Natural Resources, Rutgers University

Introduction

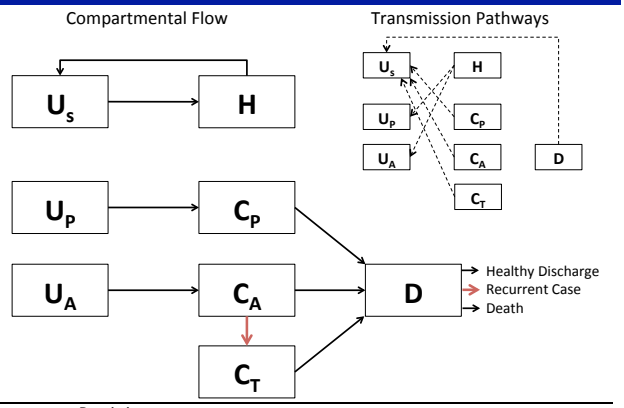
Clostridium difficile infection (CDI) is a major source of healthcare-associated infections, affecting patients with altered intestinal flora such as those taking antibiotics. Fecal microbiota transplantation (FMT) restores a patient's intestinal flora and has been proposed as a treatment for complex, recurrent cases of CDI.

We use a stochastic compartmental model, simulated using Gillespie's Direct Method, to explore the use of FMT to prevent and treat CDI in a 12-bed intensive care unit.

Four scenarios were considered:

- Post-infection FMT to prevent recurrent cases
- Prophylactic FMT to prevent incident infection in high-risk patients on antibiotics
- Prophylactic FMT to prevent incident infection in high-risk patients on antibiotics and proton pump inhibitors (PPIs)
- Combined post-infection and prophylactic treatments

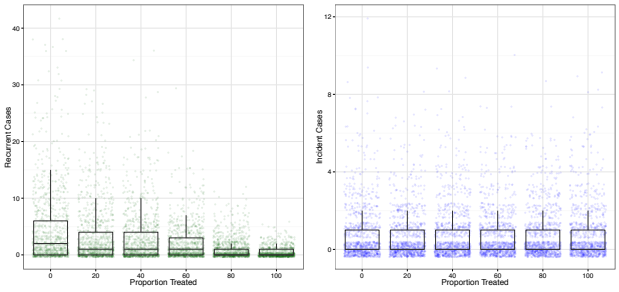
Mathematical Model



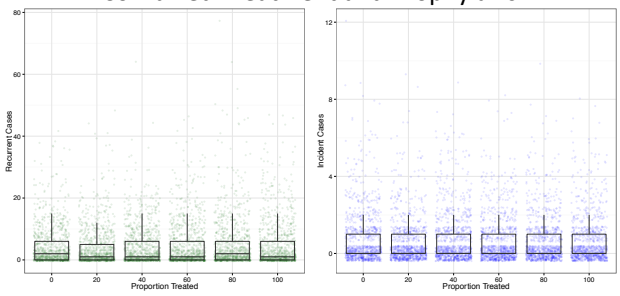
Compartment:	Description:
U_S	Hospital staff (doctors, nurses, etc.) with hands not contaminated with *C. difficile*
H	Hospital staff with hands contaminated with *C. difficile*
U_A	Patients not colonized with *C. difficile* with high-risk of acquiring active infection (on certain antibiotics, proton pump inhibitors, etc.)
U_P	Patients colonized with *C. difficile* with low-risk of acquiring active infection
C_A	Patients colonized with *C. difficile* with high-risk of acquiring active infection
C_P	Patients colonized with *C. difficile* with low-risk of acquiring active infection
D	Patients with an active infection

Results and Conclusions

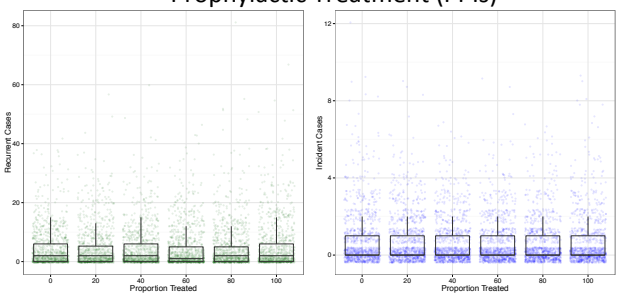
Post-infection Treatment



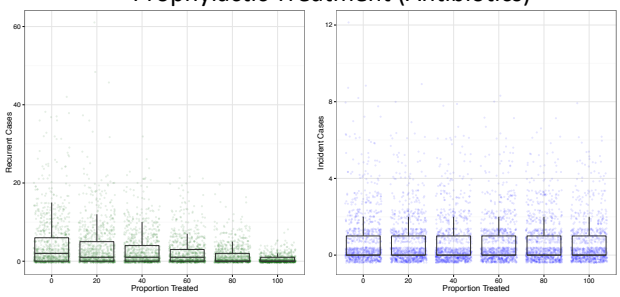
Combined Treatment and Prophylaxis



Prophylactic Treatment (PPIs)



Prophylactic Treatment (Antibiotics)



- Post-infection treatment results in a considerable reduction in recurrent cases
- No major impact from treating high-risk patients prophylactically
- FMT needs to be paired with other hospital infection control measures to combat within-hospital *C. difficile* transmission

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

DUKE INFECTION CONTROL OUTREACH NETWORK